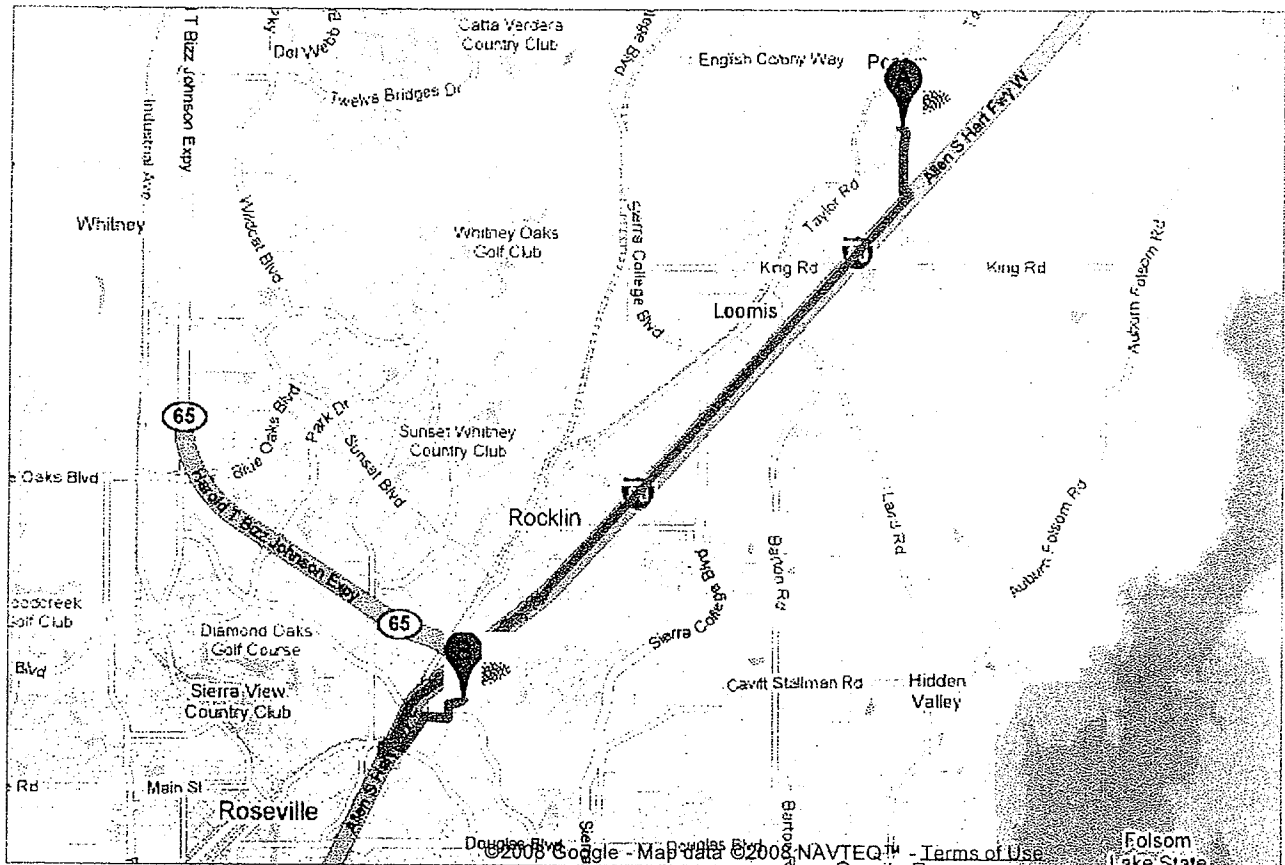


FIGURE D-1
Hospital Route Map






Start **Taylor Rd & Penryn Rd**
Penryn, CA 95663
 End **1 Medical Plaza Dr**
Roseville, CA 95661
 Travel **9.5 mi – about 13 mins**



Taylor Rd & Penryn Rd
Penryn, CA 95663

Drive: 9.5 mi – about 13 mins

1. Head **southeast** on **Penryn Rd** toward **Penryn Estates Dr** 0.6 mi
1 min
- ← 2. Turn **left** to merge onto **I-80 W** toward **Sacramento** 7.5 mi
8 mins
3. Take exit **105A** to merge onto **Eureka Rd** toward **Taylor Rd** 0.5 mi
1 min
- ← 4. Turn **left** at **Taylor Rd** 0.4 mi
1 min
- 5. Turn **right** at **E Roseville Pkwy** 0.2 mi
1 min
- ← 6. Turn **left** at **Medical Plaza Dr** 0.1 mi
1 min
- 7. Turn **right** to stay on **Medical Plaza Dr** 0.2 mi
- ← 8. Turn **left** to stay on **Medical Plaza Dr** 207 ft

 **1 Medical Plaza Dr**
Roseville, CA 95661

These directions are for planning purposes only. You may find that construction projects, traffic, or other events may cause road conditions to differ from the map results.

Map data ©2008 NAVTEQ™

APPENDIX D-A

CHEMICAL HAZARD INFORMATION



CHEMICAL HAZARD INFORMATION

The following information is excerpted from the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile Information Sheets, (ATSDR, 2003). For more information, call the ATSDR Information Center at 1-888-422-8737, or check the ATSDR website at <http://www.atsdr.cdc.gov/toxpro2.html>.

A-1 Arsenic

Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts.

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Arsenic cannot be destroyed in the environment. It can only change its form. Arsenic in air settles to the ground or washes out of the air during rain. Many arsenic compounds can dissolve in water. Fish and shellfish can accumulate arsenic, but the arsenic in fish is mostly in a form that is not harmful.

Exposure to arsenic may occur by eating food, drinking water, or breathing air containing arsenic, breathing contaminated workplace air, breathing sawdust or burning smoke from wood treated with arsenic, living near uncontrolled hazardous waste sites containing arsenic, living in areas with unusually high natural levels of arsenic in rock.

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with inorganic arsenic may cause redness and swelling. Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate



cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

The OSHA 8-hour TWA PEL for arsenic is 0.050 mg/m^3 . The NIOSH 15-minute REL is 0.002 mg/m^3 .

A-2 Lead

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. It has no special taste or smell. Lead can be found in all parts of our environment. Most of it comes from human activities like mining, manufacturing, and the burning of fossil fuels. Lead has many different uses, most importantly in the production of batteries. Lead is also in ammunition, metal products (solder and pipes), roofing, and devices to shield x-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

When lead enters the environment it does not break down, but sunlight, air, and water change lead compounds. When released to the air from industry or burning of fossil fuels or waste, it stays in air about 10 days. Most of the lead in material comes from particles falling out of the air. City soils also contain lead from landfills and leaded paint. Lead sticks to soil particles. It does not move from soil to underground water or drinking water unless the water is acidic or "soft." It stays a long time in both soil and water.

Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is breathed or swallowed. Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common after exposure to high levels of lead. In adults, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can cause abortion and damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

The OSHA PEL for lead is 0.050 mg/m^3 . NIOSH states that air concentrations should be maintained so that worker blood lead remains less than $0.060 \text{ mg Pb/100 g}$ of whole blood.



A-3 Organic Pesticide Compounds

DDT (1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane) is a pesticide that was once widely used to control insects on agricultural crops and insects that carry diseases like malaria and typhus, but is now used in only a few countries to control malaria. Technical-grade DDT is a mixture of three forms, *p,p'*-DDT (85%), *o,p'*-DDT (15%), and *o,o'*-DDT (trace amounts). All of these are white, crystalline, tasteless, and almost odorless solids. Technical grade DDT may also contain DDE (1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethylene) and DDD (1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane) as contaminants. DDD was also used to kill pests, but to a far lesser extent than DDT. One form of DDD (*o,p'*-DDD) has been used medically to treat cancer of the adrenal gland. Both DDE and DDD are breakdown products of DDT.

DDT does not occur naturally in the environment. After 1972, the use of DDT was no longer permitted in the United States except in cases of a public health emergency. It is, however, still used in some other areas of the world, most notably for controlling malaria. The use of DDD to kill pests has also been banned in the United States.

Before 1973 when it was banned, DDT entered the air, water, and soil during its production and use as an insecticide. DDT is present at many waste sites, including NPL sites; releases from these sites might continue to contaminate the environment. Most DDT in the environment is a result of past use; DDD was also used as a pesticide to a limited extent in the past. DDT still enters the environment because of its current use in other areas of the world. DDE is only found in the environment as a result of contamination or breakdown of DDT. DDD also enters the environment during the breakdown of DDT.

Large amounts of DDT were released into the air and on soil or water when it was sprayed on crops and forests to control insects. DDT was also sprayed in the environment to control mosquitoes. Although the use of DDT is no longer permitted in the United States, DDT may be released into the atmosphere in other countries where it is still manufactured and used, including Mexico. DDT, DDE and DDD may also enter the air when they evaporate from contaminated water and soil. DDT, DDE, and DDD in the air will then be deposited on land or surface water. This cycle of evaporation and deposition may be repeated many times. As a result, DDT, DDE, and DDD can be carried long distances in the atmosphere. These chemicals have been found in bogs, snow, and animals in the Arctic and Antarctic regions, far from where they were ever used. Some DDT may have entered the soil from waste sites. DDT, DDE, and DDD may occur in the atmosphere as a vapor or be attached to solids in air. Vapor phase DDT, DDE, and DDD may break down in the atmosphere due to reactions caused by the sun. The half-life of these



chemicals in the atmosphere as vapors (the time it takes for one-half of the chemical to turn into something else) has been calculated to be approximately 1.5-3 days. However, in reality, this half-life estimate is too short to account for the ability of DDT, DDE, and DDD to be carried long distances in the atmosphere.

DDT, DDE, and DDD last in the soil for a very long time, potentially for hundreds of years. Most DDT breaks down slowly into DDE and DDD, generally by the action of microorganisms. These chemicals may also evaporate into the air and be deposited in other places. They stick strongly to soil, and therefore generally remain in the surface layers of soil. Some soil particles with attached DDT, DDE, or DDD may get into rivers and lakes in runoff. Only a very small amount, if any, will seep into the ground and get into groundwater. The length of time that DDT will last in soil depends on many factors including temperature, type of soil, and whether the soil is wet. DDT lasts for a much shorter time in the tropics where the chemical evaporates faster and where microorganisms degrade it faster. DDT disappears faster when the soil is flooded or wet than when it is dry. DDT disappears faster when it initially enters the soil. Later on, evaporation slows down and some DDT moves into spaces in the soil that are so small that microorganisms cannot reach the DDT to break it down efficiently. In tropical areas, DDT may disappear in much less than a year. In temperate areas, half of the DDT initially present usually disappears in about 5 years. However, in some cases, half of the DDT initially present will remain for 20, 30, or more years.

In surface water, DDT will bind to particles in the water, settle, and be deposited in the sediment. DDT is taken up by small organisms and fish in the water. It accumulates to high levels in fish and marine mammals (such as seals and whales), reaching levels many thousands of times higher than in water. In these animals, the highest levels of DDT are found in their adipose tissue. DDT in soil can also be absorbed by some plants and by the animals or people who eat those crops. People in the United States are exposed to DDT, DDE, and DDD mainly by eating foods containing small amounts of these compounds. Although not common today, exposure to DDT could also occur through inhalation or absorption through the skin during the handling or application of DDT. Even though DDT has not been used in this country since 1972, soil may still contain some DDT that may be taken up by plants and eaten by animals and people. DDT from contaminated water and sediment may be taken up by fish. The amount of DDT in food has greatly decreased since DDT was banned and should continue to decline. In the years 1986 to 1991, the average adult in the United States consumed an average of 0.8 micrograms (a microgram is a millionth of a gram) of DDT a day. Adults consumed slightly different amounts based on their age and sex. The largest fraction of DDT in a person's diet comes from meat, poultry, dairy products, and fish, including the consumption of sport fish. Leafy vegetables



generally contain more DDT than other vegetables, possibly because DDT in the air is deposited on the leaves. Infants may be exposed by drinking breast milk.

DDT or its breakdown products are still present in some air, water, and soil samples. However, levels in most air and water samples are presently so low that exposure is of little concern. DDT levels in air have declined to such low levels that it often cannot be detected. In cases where DDT has been detected in air, it is associated with air masses coming from regions where DDT is still used or from the evaporated DDT from contaminated water or soil. *p,p'*-DDT and *p,p'*-DDE concentrations measured in air in the Great Lakes region in 1990 reached maximum levels of 0.035 and 0.119 nanograms (a nanogram is a billionth of a gram) of chemical per cubic meter of air (ng/m^3), respectively. Levels were generally much lower, especially during the winter months. In 1995-1996, soils in the corn belt, where DDT was heavily used in the past, contained on the average about 10 nanograms of DDT in a gram of soil. In recent years, most surface water has not contained detectable amounts of DDT.

People who work or live around NPL sites or work with contaminated soil or sediment would most likely be exposed by accidentally swallowing soil, having skin contact with the soil, inhaling DDT vapor, or breathing in DDT in dust.

Today in the United States, DDT, DDE, or DDD enters the body mainly when a person eats contaminated food. The actual amounts of DDT, DDE, and DDD absorbed from foods depends on both the concentration of chemical in the food and the amount of food eaten. Small amounts of DDT, DDE, and DDD may also be breathed in and absorbed into the body. DDT, DDE, and DDD are often attached to particles too large to pass very far into the lungs after air containing them is breathed. These particles are more likely to be carried upward in the mucus of the air passages and swallowed than for the DDT to be absorbed in the lungs. DDT, DDE, and DDD do not enter the body through the skin very easily.

Once inside the body, DDT can break down to DDE or DDD. DDE and DDD, in turn, break down to other substances (called metabolites). DDT, DDE, and DDD are stored most readily in fatty tissue, especially DDE. Some of these stored amounts leave the body very slowly. Levels in fatty tissues may either remain relatively the same over time or even increase with continued exposure. However, as exposure decreases, the amount of DDT in the body also decreases. DDT metabolites leave the body mostly in urine, but may also leave by breast milk and pass directly to nursing infants.



Eating food with large amounts (grams) of DDT over a short time would most likely affect the nervous system. People who swallowed large amounts of DDT became excitable and had tremors and seizures. They also experienced sweating, headache, nausea, vomiting, and dizziness. These effects on the nervous system went away once exposure stopped. The same type of effects would be expected by breathing DDT particles in the air or by contact of the skin with high amounts of DDT. Tests in laboratory animals confirm the effect of DDT on the nervous system.

No effects have been reported in adults given small daily doses of DDT by capsule for 18 months (up to 35 milligrams [mg] every day). People exposed for a long time to small amounts of DDT (less than 20 mg per day), such as people who worked in factories where DDT was made, had some minor changes in the levels of liver enzymes in the blood. A study in humans showed that increasing concentrations of *p,p'*-DDE in human breast milk were associated with reductions in the duration of lactation. An additional study in humans found that as the DDE levels in the blood of pregnant women increased, the chances of having a pre-term baby also increased. It should be mentioned, however, that the levels of DDE in the blood at which this was noticed were higher than those currently found in women from the general population in the United States, but not higher than those that may be found in women in countries where DDT is still being used.

Animal studies show that long-term exposure to moderate amounts of DDT (20-50 mg per kilogram [kg] of body weight every day) may affect the liver. Tests in animals also suggest that short-term exposure to DDT and metabolites in food may have a harmful effect on reproduction. In addition, we know that some breakdown products of DDT can cause harmful effects on the adrenal gland. This gland is situated near the kidney and produces hormones (substances produced by organs and released to the bloodstream to regulate the function of other organs). Studies in animals have shown that oral exposure to DDT can cause liver cancer. Studies of DDT-exposed workers did not show increases in deaths or cancers. Based on all of the evidence available, the Department of Health and Human Services has determined that DDT is reasonably anticipated to be a human carcinogen. Similarly, the International Agency for Research on

Cancer (IARC) has determined that DDT is possibly carcinogenic to humans. EPA has determined that DDT, DDE, and DDD are probable human carcinogens.

The OSHA 8-hour TWA PEL for DDT, DDE and DDD is 1.0 mg/m³. The NIOSH 15-minute REL is 0.5 mg/m³.



Endrin is a solid, white, almost odorless substance that does not occur naturally in the environment. It was used as a pesticide to control insects, rodents, and birds. Most likely exposure pathways include ingestion, absorption and inhalation. Exposure to endrin can cause various harmful effects including death and severe central nervous system (brain and spinal cord) injury. No long-term health effects have been noted in workers who have been exposed to endrin by breathing or touching it. The EPA has determined that endrin is not classifiable as to its human carcinogenicity because there is not enough information to allow classification. Endrin was banned for public health reasons, and has not been produced or sold for general use in the United States since 1986.

Methoxychlor is a manufactured chemical that does not occur naturally in the environment. Pure methoxychlor is a pale-yellow powder with a slight fruity or musty odor. Methoxychlor is used as an insecticide against flies, mosquitoes, cockroaches, chiggers, and a wide variety of other insects. It is used on agricultural crops and livestock, and in animal feed, barns, grain storage bins, home garden, and on pets. Methoxychlor is also known as DMDT, Marlate®, or Metox®. Most likely exposure pathways include ingestion, absorption and inhalation.

There is very little information on how methoxychlor can affect people's health. Animals exposed to very high amounts of methoxychlor suffered tremors and convulsions and seizures. Because methoxychlor is broken down quickly in the body, you are not likely to experience these effects unless you are exposed to very high levels.

Animal studies show that exposure to methoxychlor in food or water harms the ovaries, uterus, and mating cycle in females, and the testes and prostate in males. Fertility is decreased in both male and female animals. These effects can occur both in adult and in developing animals and could also occur following inhalation or skin contact. These effects are caused by a breakdown product of methoxychlor which acts as a natural sex hormone. These effects have not been reported in humans, but they could happen.

Most of the information available from human and animal studies suggests that methoxychlor does not cause cancer. The International Agency for Research on Cancer (IARC) and the EPA have determined that methoxychlor is not classifiable as to its carcinogenicity to humans.



APPENDIX D-B

HEAT STRESS INFORMATION



SIGNS AND SYMPTOMS OF HEAT STRESS

Type	Cause	Signs and Symptoms
Heat rash	May result from continuous exposure to heat or humid air	<ul style="list-style-type: none">○ Rash or itching feeling on skin
Heat cramps	Are caused by heavy sweating with inadequate electrolyte replacement	<ul style="list-style-type: none">○ Muscle spasms○ Pain in the hands, feet, and abdomen
Heat exhaustion	occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration	<ul style="list-style-type: none">○ Pale, cool, moist skin○ Heavy sweating○ Dizziness○ Nausea○ Fainting
Heat stroke	the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained.	<ul style="list-style-type: none">○ Red, hot, usually dry skin○ Lack of or reduced perspiration○ Nausea, dizziness and confusion



APPENDIX D-C
RESUMES OF KEY PERSONNEL



Mr. Flores has managed projects and performed fieldwork on numerous soil and groundwater impact investigations resulting from fugitive releases of petroleum hydrocarbons, chlorinated and organic solvents, heavy metals, and pesticides. He has performed field investigation and/or managed over 300 underground storage tank investigations and closure assessments in locations throughout the southeastern United States and Mexico for clients that include international oil and gas corporations and government entities. Other projects have included Remedial Feasibility Studies for several DOD facilities, as well as remedial investigations of a variety of large-scale petroleum storage and distribution, and other commercial and industrial facilities, including chemical processing plants.

Mr. Flores has acted as a section manager with teams of geologists, engineers and other scientists, in the siting analysis, hydrogeological studies, and subsequent design and installation of large-scale groundwater monitoring well networks for the construction or expansion of RCRA Subtitle D landfill facilities. Mr. Flores' experience also includes numerous Phase I site assessments, international multimedia environmental compliance and environmental health and safety (EHS) audits, as well as cultural resource management investigations.

Mr. Flores has provided technical guidance to, and intermediary communication between, industry and regulatory agencies in the United States, Mexico, and Spain. In Barcelona, Spain, his interpretation and presentation of hydrogeological and analytical data from a groundwater investigation provided a major U.S. Corporation with a successful liability defense before the Spanish regulatory authority.

Currently Mr. Flores has been working with County and State Regulators on projects requiring Toxicological Human Health Risk Evaluations and Cleanup.

Mr. Flores' Professional Affiliations include:

Association of Engineering Geologists (AEG)
Groundwater Resource Association of California (GRA)
National Registry of Environmental Professionals (NREP)
Association of Environmental Professionals (AEP)
Industrial Managers Association (*Louisiana, USA*)
Baton Rouge Geological Society (*Louisiana, USA*)
Environmental Assessment Association (*USA*)

Work Experience

- 9/02 - Present Wallace-Kuhl & Associates, Inc.
Senior Geologist
- 9/01 - 4/02 Toxicology & Environmental
Consultants
Contract Geologist
- 3/00 - 9/01 Pine Bluff Demilitarization Facility.
Contract Geologist (Turner Env.)
- 12/96-1/99 Parker EHS Services, Inc.
Senior Associate
- 7/96-11/96 Fort Polk, La. (DOD).
Contract Geologist (URS)
- 1/91-6/96 RUST Environment & Infrastructure
Staff to Project Geologist
- 1985-1991 Cultural Resource Management
Archeologist

Selected Project Experience

- Removal Action Workplan, Plumas Ranch
Elementary, Plumas USD
- Removal Action Workplan, Loomis Hills Estates,
Loomis, California
- Removal Action Workplan, Katherine Albani
School, Elk Grove USD
- Preliminary Endangerment Assessment, Natomas
Crossing, Natomas USD, California
- Preliminary Endangerment Assessment Sunset West
Third Middle School, Rocklin USD, California
- Preliminary Endangerment Assessment, Regency
Park, Natomas USD, California
- In-Situ Groundwater Bioremediation Project, Dow
Industries, Pittsburg, California
- Groundwater Remedial Investigation, Mark IV
Industries, Barcelona (Sitges), Spain.
- Soil & Groundwater Investigation: City of
Guadalajara, State of Jalisco, Mexico
- Cultural Liaison/Assisting Geologist; Coto Brus,
Costa Rica

Education and Registration

- Post-Graduate Studies in Cultural Geography,
Latin American Studies. Environmental Law &
Environmental Management Systems
- Louisiana State University, Baton Rouge
Bachelor of Science, Geology (1983)
- Registered Professional Geologist No. 7777,
California
- Registered Professional Geologist No. TN2540,
Tennessee (Inactive)
- Registered Environmental Manager No. 11341
NREP
- Certified Environmental Manager No.
State of Nevada



**WALLACE • KUHL
& ASSOCIATES INC.**

MATTHEW A. TAYLOR

HIGHER EDUCATION

San Diego State University
Civil Engineering

EXPERIENCE

07/01 – Present	Wallace-Kuhl & Associates, Inc. Senior Environmental Specialist
4/94 – 6/01	Wallace-Kuhl & Associates, Inc. Senior Environmental Technician
5/92 – 3/94	Alisto Engineering Staff Engineer

PROFESSIONAL AFFILIATIONS

Groundwater Resource Association of California
Sacramento Claims Association

MAJOR PROJECTS

Crystal Cream and Butter Company, Stockton and Sacramento, California
California State Capitol Restoration Project, Sacramento, California
Harbor Boulevard Widening Project, West Sacramento, California
Bill Reid Painting, Sacramento, California
United Rentals, Stockton, California
California Highway Patrol – Meadowview Facility, Sacramento, California
Sunset West, Rocklin, California
Norcal Beverage Company, South Lake Tahoe, California
Yolo Fliers Club, Woodland, California
Spanda Industrial, Sacramento, California
Cal Worthington Chevrolet, Sacramento, California
Schnitzer Steel Products, Rancho Cordova, California

BRYCE R. THOMAS

SENIOR ENVIRONMENTAL TECHNICIAN

Mr. Thomas has extensive field experience in operating and maintaining various Soil Vapor Extraction and Groundwater Treatment Systems. He is also responsible for maintaining equipment and supplies, inventory, budgeting, and purchasing of in-house equipment.

Mr. Thomas' projects have included soil and surface water sampling and monitoring, and quarterly monitoring for groundwater monitoring in areas where long-term monitoring wells have been installed.



HIGHER EDUCATION:

California State University, Sacramento
Bachelor of Science, Business Administration,
MIS Concentration (2001)

EXPERIENCE:

3/04 - Present	Wallace-Kuhl & Associates, Inc. Senior Environmental Technician
5/95 - 3/04	Ideal Tractor Inc. Heavy Equipment Repair Technician

RELEVANT PROJECTS:

RH Phillips Esparto, Esparto
Oak Ridge Winery, Lodi
Turner Road Vinters, Lodi
Granite Capay Project, Capay
701 Bidwell, Folsom
3815 Florin Road, Sacramento
Steele Canyon, Napa
Savarino Family Trust, Sacramento
660 HWY 12, Rio Vista
Natomas Air Park, Sacramento
Morton – Alco & Unocal Operable, Stockton
1907 N. Texas Street, Fairfield
Rominger Property, Winters
Nevada City Gas Company, Nevada City

DAYNA M. CORDANO

STAFF GEOLOGIST

Ms. Dayna M. Cordano has been employed in the field of environmental and geologic resources consulting since 2006. She graduated from the University of California, Davis with a degree in Geology and a minor in English. Her project experience includes Phase I and Phase II Environmental Site Assessments for both commercial and residential projects. Ms. Cordano has performed soil sampling investigations and has overseen groundwater monitoring well installations. Additionally, she is 40-hour HAZWOPER certified.



HIGHER EDUCATION:

University of California, Davis
Bachelor of Science, Geology (2005)

EXPERIENCE:

04/06 to Present Wallace-Kuhl & Associates, Inc.
Staff Geologist

RELEVANT EXPERIENCE:

Vista Del Lago High School, Folsom
Russell Ranch Elementary School, Folsom
Northborough II Elementary School, Sacramento County
Plumas Ranch Elementary School, Yuba County
Gavern Lane Property, Sacramento County
Evergreen Avenue Vacant Parcels, West Sacramento
1536, 1540, 1544 Sacramento Avenue, West Sacramento
Laguna Gateway Phase 3, Elk Grove
Humes Property Update, Elk Grove
Stockton Waterfront Properties, Stockton
Poppy Ridge Road, Elk Grove
Shirland Tract Road Site, Auburn

APPENDIX E

SAMPLING AND ANALYSIS PLAN



SAMPLING AND ANALYSIS PLAN
REMOVAL ACTION WORKPLAN

PENRYN PROPERTY
Penryn, California

WKA No. 5887.06

Prepared for:

Penryn Development, LLC
3990 Ruffin Road, Suite 100
San Diego, California 92123

Prepared By:

Wallace-Kuhl & Associates, Inc.
500 Menlo Dr., Ste. 100
Rocklin, CA 95765



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1.0 INTRODUCTION

1.1 General

This Sampling and Analysis Plan (SAP) presents a summary of additional soil sampling work proposed in conjunction with remediation activities described in the RAW for the Penryn Property, herein referred to as "site." The site consists of an approximately 15-acre parcel of land located approximately one and one-half miles northeast of the central business district of the incorporated town of Loomis, California. Together with the Quality Assurance Project Plan (QAPP, included as Appendix F of this RAW), this SAP presents the plan for sampling and analysis as part of a removal action to be performed under the direction of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC).

The majority of the site has an undulating surface, with numerous igneous rock outcrops exposed on the surface. The site is presently undeveloped (absent of aboveground structures), and the majority of its surface is covered with a moderate to dense growth of green and dried grasses, weeds, and brush, as well as numerous evergreen and deciduous trees, including some native oaks. Several dirt roads and a South Placer Municipal Utility District (SPMUD) sewer easement are present on-site. Stream channels bisect the central and eastern portions of the site. The stream channels have dense growths of trees, berry vines, and grasses.

Elevated residual pesticide concentrations in site soils exceeding levels protective of human health (almost exclusively arsenic) have been identified on site. The objective of the proposed remedial activity is to excavate and relocate impacted soils to a Class II landfill as described in detail in Section 7, Remedial Design and Implementation Plan (RDIP), of the RAW. Sampling data collected as part of the RAW, will consist of soil confirmation sample analyses used to evaluate the effectiveness of soil removal activities, and landfill disposal options.

Analytical data is summarized in tables included within the main body of this RAW. Information pertaining to selected analytical parameters, data quality objectives, and the anticipated project decisions are detailed within the QAPP, provided in Appendix F.

1.2 Project History

Six previous site investigations were conducted by WKA to identify and delineate the extent of chemically affected soils on the site due to former agricultural activities. Two



Phase I Environmental Site Assessments (ESAs) were conducted independently for the Chavez Property (APN 043-060-053) in May 2004 and the Mott Property (APN 043-060-052) in August 2004. Following the initial ESAs, a combined Phase II Environmental Site Investigation for the Chavez-Mott Property was conducted in March 2006 to further delineate the extent of chemically affected soils on the site. Following evaluation of the analytical results from the Phase II ESA and consultation with the DTSC, a Supplemental Site Investigation (SSI) was conducted in October 2006. An SSI II Workplan was then prepared in June 2007 under the oversight of the DTSC, preceding a September 2007 SSI II Investigation report. The individual reports are discussed in detail in the body of the RAW.

2.0 PROJECT ORGANIZATION

This section provides a description of the organizational structure and responsibilities of the individual positions for this project. This description defines the lines of communication and identifies key personnel assigned to various activities for the project.

2.1 Regulatory Agency

Mr. Duane White is the Project Manager for the site action, representing the DTSC. Mr. White will provide regulatory oversight of this RAW, with responsibilities including the review and approval of Workplans and work activities for the duration of the project. Mr. White will provide direction of DTSC policy and environmental objectives.

2.2 Project proponents

Penryn Development, LLC, under direction of Forum Consultants, Inc. has agreed to seek the review and approval of the DTSC on environmental matters relating to site removal activities. The project proponent may perform document review of related Workplans, reports, and drawings for activities associated with this project.

2.3 Wallace-Kuhl & Associates, Inc. (WKA)

Mr. William (Bill) Flores is the WKA Project Manager and primary author of the RAW. Mr. Flores is responsible for the overall implementation of programs associated with the RAW. As Project Manager, Mr. Flores, will be the primary contact for project proponents and the DTSC and provide overall management of the project schedule and budget. Other responsibilities include coordination and preparation of the required reports and assignment of technical responsibilities to appropriate personnel or subcontractors.



Mr. Matthew Taylor will act as the WKA Project Superintendent. Mr. Bryce Thomas will be the Site Safety Officer (SSO) during site activities. Mr. Taylor will be responsible for the day-to-day coordination of field activities under the direction of the Project Manager, including coordination of subcontractors and field crews to ensure that field activities conform to the specifications presented in the site-specific SAP. Mr. Thomas will ensure that elements of the Health and Safety Plan (HASP, included as Appendix D in the RAW) related activities are performed correctly.

Mr. Flores will additionally act as the Quality Assurance Manager, ensuring that Quality Assurance / Quality Control protocols are met both in the field and laboratory. Mr. Flores will also provide oversight of any related data validation activities.

2.4 Analytical Laboratory

The primary offsite laboratory will be California Laboratory Services (CLS) in Rancho Cordova, California. Mr. Raymond Oslosky, CLS Laboratory Manager, will report to the WKA Project Manager on all aspects of the sample analysis. In addition, the WKA QA Manager will be advised of any matters related to data quality during the course of the removal action.

3.0 PROJECT OBJECTIVES, SCOPE AND SAMPLING RATIONALE

3.1 Project Objectives

Arsenic has been identified in site soil above concentrations deemed protective of human health and the environment. Additionally, some lead and organic pesticides in association with areas containing elevated arsenic have been identified. The selected remedial activity will include excavation and relocation of the impacted soils to a Class II landfill as described in detail in Section 7, RDIP of the RAW. The remedial action objective (RAO) is to achieve an overall post-mitigation site soil arsenic concentration of 8.0 mg/kg at the 95% upper confidence level (UCL) of the arithmetic mean by removing arsenic concentrations exceeding 16 mg/kg in site soil.

3.2 Project Scope

The scope of sampling efforts associated with this project will be generally limited to the collection of excavation floor and sidewalls following removal of soil determined to contain arsenic concentration in excess of 16 mg/kg. The depth of the excavation pit is expected range from 1.0 to 2.0-feet below surrounding grade. Confirmation soil samples will be collected by WKA. CLS, located in Sacramento, California will perform the soil



sample analyses. WKA and CLS will utilize methodologies described in this SAP in carrying out the following soil-sampling activities.

This sampling program has been designed to provide the type and quantity of data needed to satisfy the Data Quality Objectives (DQOs) as described in the QAPP (included as Appendix F of the RAW). The DQOs have been used to design the data collection activities presented in this SAP.

The proposed sampling effort includes the sampling for soil contaminants identified through the process of human health screening evaluation as chemicals of potential concern (COPCs) at the site. Occurrence of shallow bedrock, or planned excavation to bedrock may alter the actual sample number or sample locations of excavation floor samples. Additional confirmation sampling will be implemented as needed.

The arsenic in soil to be excavated from the mitigation areas does not pose an unacceptable risk to onsite construction workers or utility workers at the property provided reasonable and normal care is taken to avoid unnecessary exposure.

3.3 Sampling Rational

The central cleanup objective is to achieve a post-removal arsenic concentration goal of 8.0 mg/kg (remedial action objective) at the 95% UCL of the post cleanup arithmetic mean, by removing arsenic concentrations exceeding 16 mg/kg in site soil (remedial action screening objective). Secondary cleanup objectives will include removal of impacted site soil with organic pesticide concentrations cumulatively exceeding the Total Threshold Limit Concentration (TTLC) of 1.0 mg/kg; and removal of impacted site soil with lead concentration exceeding 150 mg/kg.

Confirmation soil samples will be analyzed to evaluate the effectiveness of the soil removal activities by confirming that no significant residual soil contamination remains following soil removal activities. The excavated site perimeters and floors will be sampled to make this determination.

4.0 METHODOLOGIES FOR SOIL SAMPLING AND ANALYSIS

Following excavation activities, confirmation grab samples will be collected from the excavation floors and sidewalls to verify the effectiveness of the removal action. Typical proposed confirmation sample locations are presented on Figure 6 in the RAW. This SAP proposes collection of approximately 150 confirmation samples. Nine excavation



floor samples will be collected from Mitigation Area 1, 16 excavation floor samples will be collected from Mitigation Area 2, and 75 excavation floor samples will be collected from Mitigation Area 3. This sampling frequency corresponds to approximately 75% of the 25-foot square grid areas shown within Mitigation Areas 1 and 2, and 75% of 50-foot square grid areas shown within Mitigation Area 3. WKA proposes collection of 50 sidewall samples. Sidewall samples will be collected at a frequency of one sample per 50 linear feet of excavation perimeter from Mitigation Areas 1 and 2 (6 and 9 soil samples respectively). Sidewall samples will be collected at a frequency of one sample per 75 linear feet of Mitigation Area 3 excavation perimeter (approximately 35 samples).

Confirmation soil sample analyses will additionally include analysis for DDT, DDD, DDE or lead depending on the location of the sample relative to pre-cleanup contaminant concentrations. Soil samples collected *only* in those areas that previously yielded elevated concentrations of DDT, DDD, DDE or lead (above TTLC or CHHSL, respectively) will be sampled for those constituents *in addition to arsenic*. The locations of the proposed lead and organic pesticide samples are shown on Figure 6.

4.1 Sample Collection

Each sample will be collected by nitrile-gloved hand using a clean shovel, a 3.5" stainless steel hand auger, or stainless steel trowel to access and expose the confirmation sample. Soil samples will be collected directly into the appropriate laboratory-supplied vessel for transport to the analytical laboratory.

A sample identification label will be affixed to each sample jar following sealing. The identification label will be completed with a unique sample identification, time and date of collection, location identification, and the sampler's initials. Following labeling, each sample will be placed in a plastic bag and stored in a chilled wet-ice cooler for transportation to CLS in Rancho Cordova, California, a California Department of Health Services Certified laboratory, for chemical analysis.

4.2 Sample Handling and Custody

Samples will be described in the field using the Unified Soil Classification System (USCS). Samples will be placed in an ice chest containing ice, and submitted with chain-of-custody documentation to a California certified laboratory for analysis. A detailed sampling map (based on the proposed confirmation sample location map provided as Plate 6 within the RAW) will be prepared so that tested locations are easily referenced and identified. Duplicate samples at the rate of ten percent (10%) will be collected



during the confirmation-sampling event. Detailed QA/QC methods and objectives are outlined in the QAPP included as Appendix F of the RAW.

A sample identification label will be affixed to each sample tube or glass jar following sealing. The identification label will be completed with a unique sample identification, time and date of collection, location identification, and the sampler's initials. Following labeling, each sample will be placed in a plastic bag and stored in a chilled wet-ice cooler for transportation under chain-of-custody protocols to CLS in Rancho Cordova, California for chemical analysis.

4.3 Investigation Derived Waste

Investigation derived waste for this investigation will be limited to rinsate water (Alconox™ mixture) and personal protective equipment (nitrile gloves). On the basis of results from previous investigations these materials will be disposed of as non-regulated waste.

4.4 Equipment Decontamination

All equipment will be cleaned prior to each boring sample by washing in an Alconox™ solution, followed by fresh and distilled water rinses.

4.5 Chemical Analyses

A state-certified commercial analytical laboratory will analyze selected confirmation samples for one or more chemical parameters. Project-specific laboratory methods and detection limits for COPCs are provided in Table E-1 below:

Table E-1 DELINEATION SAMPLE ANALYSIS			
COPC	Media	Method	Reporting Limit
Arsenic	Soil	7060A	0.5 mg/kg
Lead	Soil	6010B	2.5 mg/kg
DDE	Soil	8081A	0.0033 mg/kg
DDT	Soil	8081A	0.0033 mg/kg
Endrin	Soil	8081A	0.0033 mg/kg
Methoxychlor	Soil	8081A	0.017 mg/kg

Note: Solubility analyses will additionally be performed for landfill characterization with results submitted to the proposed landfill. Additional samples will be collected from the stockpiled material for any additional analysis required by the landfill.



All samples will be analyzed for arsenic. Samples collected at locations where lead or organochlorine compounds were detected above their respective California Human Health Screening Level (CHHSL) will be additionally analyzed for that COPC. Solubility analyses will additionally be performed for landfill characterization with results submitted to the proposed landfill. Additional samples will be collected from the stockpiled material for any additional analysis required by the landfill.

Samples will be delivered to the analytical laboratory on the same day as collected, if time permits, and no later than the day following collection. All samples will be secured under proper chain of custody documentation until delivery.

The laboratory will provide standard QA/QC parameters including method blanks, surrogates, matrix spike and matrix spike duplicates, lab duplicates and initial and continuing calibration checks.

If analysis of post-excavation samples yield concentrations in excess of the remedial screening objective, additional soil removal *may* be necessary. The results of the post-excavation sampling will be discussed with DTSC prior to finalizing remedial activities.

5.0 BACKFILL MATERIAL SOIL SAMPLING

Because of the shallow depth of the proposed excavation (1.0 - 2.0-feet bgs), and lack of final site elevation grade information, WKA will request that backfilling of soil removed from the site be addressed at a later time, outside of the scope of this SAP. If required, imported soil will be qualified for appropriateness with consideration of the DTSC Information Advisory, Clean Imported Fill Material (DTSC, 2001).

6.0 HEALTH AND SAFETY PLAN FOR SOIL SAMPLING ACTIVITY

A detailed HASP, included as Appendix D of the RAW, will apply to all sampling activities associated with the RAW.



APPENDIX F
QUALITY ASSURANCE PROJECT PLAN



QUALITY ASSURANCE PROJECT PLAN
REMOVAL ACTION WORKPLAN

PENRYN PROPERTY
Penryn, California

WKA No. 5887.06

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1.0 INTRODUCTION

1.1 General

This Quality Assurance Project Plan (QAPP) has been prepared by Wallace-Kuhl & Associates, Inc. (WKA) on behalf of Penryn Development, LLC, to address quality assurance (QA) and quality control (QC) policies associated with the collection of environmental data at the proposed Penryn Property site ("site") located in the vicinity of Taylor and Penryn Roads in Penryn, California. A removal action will be performed at the site under the direction of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). United States Environmental Protection Agency (USEPA) policy requires a QAPP for all environmental data collection projects mandated or supported by the USEPA through regulations or other formalized means (USEPA, 1998a). The purpose of this QAPP is to identify the methods to be employed to establish technical accuracy, precision, and validity of data that are generated at the site.

The proposed sampling program has been designed to obtain sufficient data through collection of an adequate number of representative samples, and through implementation of a comprehensive analytical program incorporating proper QC procedures. A more detailed presentation of sampling activities is provided in the SAP, discussed above. The SAP references specified numbers and locations of samples to be collected, as well as procedures for use in collecting samples from the designated locations. This QAPP covers quality assurance details regarding field sampling, laboratory, and analytical procedures that apply to activities described in the SAP. This QAPP also provides field and laboratory personnel with instructions regarding activities to be performed before, during, and after field investigations. The Guidelines followed in the preparation of this QAPP are in general conformance to the EPA Requirements for Quality Assurance Plans for Environmental Data Operations, Final, EPA QA/R-5 (USEPA, 2001) and EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (USEPA, 1998).

Other documents incorporated in this plan include, Guidance for the Data Quality Objectives Process, EPA QA/G-4 (USEPA, 1994a) and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA, SW-846, Third Edition, 1996).

The primary offsite analytical laboratory chosen for sample analyses is California Laboratory Services (CLS) in Sacramento, California. Mr. Raymond Oslosky, CLS Laboratory Manager, will report to the WKA Project Manager on all aspects of the sample analysis. In addition, the



WKA QA Manager will be advised of any matters related to data quality during the course of the removal action.

2.0 PROJECT DESCRIPTION AND OBJECTIVES

Arsenic, lead, and several organochlorine pesticide compounds have been identified in site soil at levels deemed in excess of concentrations protective of human health and the environment. The proposed remedial activity involves the excavation and offsite relocation of impacted soils to a Class II landfill as described in detail in Section 7, Remedial Design and Implementation Plan (RDIP) of the RAW. The cleanup objective is to achieve a post-removal action goal for a 95% upper confidence level (UCL) of 8 mg/kg by removing arsenic concentrations exceeding 16 mg/kg in site soil. Sampling data collected as part of the RAW, will consist of soil confirmation sample analyses used to evaluate the effectiveness of soil removal activities. This QAPP presents information concerning the selected analytical parameters, data quality objectives, and the anticipated project decisions.

2.1 Analytical Scope

The proposed sampling effort includes the sampling of soil contaminants identified through the process of human health screening evaluation as chemicals of potential concern (COPCs) at the site. Identified COPCs include arsenic, lead, DDT, DDE, endrin and methoxychlor. Analysis of soil samples will therefore include these compounds for the purpose of confirming the effectiveness of the proposed soil removal action. A more detailed discussion of sampling and analysis rationale and COPC selection is provided in the SAP.

2.2 Data Use

Decisions to be made based upon the planned sampling and analysis effort will be determined by the data compiled from the sampling and analysis program. It is intended that data collected through implementation of this QAPP will satisfy Federal, state, and local data quality requirements. These data will be used to support the evaluation of removal action. The presence of the COPCs will be determined by the extent of valid detectable concentrations reported in the respective samples. The data will be used to evaluate the effectiveness of removal action. If results from the confirmation sampling indicate that the cleanup objective has been met, then the data will be used to support a request for a *No Further Action* consent from the DTSC, and the proposed site development will continue. If the evaluation indicates unacceptable risks of exposure, then the data will be used for further action consideration.



3.0 DATA QUALITY OBJECTIVES (DQOs)

3.1 The seven-step DQO process

Data Quality Objectives (DQOs) are quantitative and qualitative criteria, developed through the seven-step DQO process (EPA 2000b, 2000c), that clarify study objectives, define the appropriate type of data, and specify the tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support project decisions. DQOs therefore form the basis for designing data collection activities. The seven-step DQO process as it applies to this project is provided below:

Step 1: State the Problem

Arsenic was identified in site soil above concentrations deemed protective of human health and the environment. Elevated arsenic concentrations are limited to soil media. Soil with elevated arsenic concentration will be excavated and removed from the site. Confirmation soil samples will be obtained for verification of the effectiveness of the proposed cleanup action.

Step 2: Identify the Decisions

Following project cleanup activities, confirmation sample data must allow for a determination of whether remaining soil arsenic concentrations conform to the intended cleanup objectives: specifically, a post-removal action goal for a 95% upper confidence limit (UCL) of 12 mg/kg. Sample results will be used to determine whether additional cleanup efforts are necessary, or whether no further action is warranted.

Step 3: Identify Inputs to the Decisions

Data Quality Objective inputs for this project will include soil analytical test data of sufficient quality to support a determination of whether soil contamination meets or exceeds cleanup concentrations. The single proposed analysis will be for arsenic compound by EPA Method 7060A.

Step 3: Define Project Boundaries

Project boundaries will be confined to within the perimeter of the subject property as shown in Figures included in the RAW. If new data indicates substantial change in contaminant distribution, then the selection of additional sample locations may be recommended.

Step 5: Develop Decision rules

Decision rules will be based on analytical findings. Analytical results will be evaluated against the screening level of 18 mg/kg. This screening level will provide an action limit such that, if



confirmation sampling and analyses yield contaminant concentrations below the concentration, further work will be deemed unwarranted. If media sampling and analyses yield contaminant concentrations above this concentration, this data will be evaluated to determine the overall effect on the target 95% upper confidence limit (UCL) of 12 mg/kg. Further work may consist of additional soil removal.

Step 6: Specify Tolerable limits on decision errors

The number and location of sample points and media samples for site characterization is determined on the basis of professional judgment. Because there is no probability-based theory for estimating sampling errors for judgmental designs, it is not possible to specify quantitative limits for Type I and Type II decision errors. To the extent practical, sampling locations and sample point quantity will be unbiased and representative of actual site conditions.

Step 7: Optimize the Sampling Design

The optimized sampling design selected is presented in the workscope presented in the SAP (Appendix E of RAW).

3.2 Data Quality Indicators (DQIs) (Measurement Quality Objectives)

This section provides a mechanism for ongoing control and evaluation of data quality through the use of specific quality control measures relevant to field practices and laboratory analyses that will be followed throughout the course of project activities. The purpose of the QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of acceptable standard methods of analysis. Data quality indicators (DQIs) developed for this purpose are expressed in terms of precision, accuracy, representativeness, completeness, and comparability, (PARCC) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. The PARCC parameters of precision and accuracy will be evaluated quantitatively through the collection of quality control (QC) shown on Table 3-1 below.



TABLE 3-1
Penryn Property
QUALITY CONTROL SAMPLES FOR PRECISION AND ACCURACY

QC Type	Precision	Accuracy	Frequency
Field QC	Field Duplicate	None	Field Duplicate = 5 percent of samples
		Equipment Rinsate	Equipment Rinsate = 1/day/piece of equipment used for sampling (water)
		Source Water Bank	Source Water Bank = 1/source of water used for the final decontamination rinse
Laboratory QC	MS/MSD RPD	MS/MSD %R	MS/MSD = 1/20 samples
		Method Blanks	Method Blank - 1/20 samples
		LCS or Blank Spikes	LCS or Blank Spikes = 1/20 samples
		Surrogate Standards %R	Surrogate Standards = Every sample for organic analysis by GC
		Internal Standards %R	Internal Standards = Every sample for organic analysis by GC

Notes:

%R	Percent recovery
GC	Gas chromatography
LCS	Laboratory control sample
MS/MSD	Matrix spike/matrix spike duplicate
QC	Quality Control
RPD	Relative percent difference

Appendix F-A contains Quality Control Acceptance Criteria and Specific Laboratory Standard Operating Procedures, including EPA Region 9 quality control acceptance criteria for the laboratory analytical methods selected for this project. Quality Assurance (QA) information and details regarding reporting and deliverable requirements, holding times, preservation, and quantitation limits are contained in the appended documents. These specifications are developed to ensure that laboratory-generated analytical data is of acceptable quality (precision, accuracy and sensitivity) for use in environmental decision-making. The selected analytical laboratory will comply with the specifications of the DQI information provided. WKA will ensure that any deviation from the DQIs are minor and do not negatively affect data quality.

The following subsections describe each of the PARCC parameters and discuss how they will be assessed within this project.



3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where: A = first duplicate concentration
B = second duplicate concentration

Field sampling precision is evaluated by analyzing field duplicate samples.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be generated for all analytes. The results of the analysis of each MS/MSD pair will be used to calculate an RPD for evaluating precision.

3.2.2 Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, and analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent for soil samples. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where: S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike



Accuracy goals for the investigation based on the percent recovery of matrix and surrogate spikes are contained in the appended quality control acceptance criteria (Appendix F-A). Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

3.2.3 Representativeness

Representativeness expressed the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination potential.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Field blanks (when appropriate) and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

Completeness will also be evaluated as part of the data quality assessment process (EPA 2000d). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

3.2.6 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The practical



quantitation limit (PQL), or reporting limit, represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a given sample matrix. The PQL for specific analytical methods and sample matrices, such as soil or water, are typically several times the MDL to allow for matrix effects. Table 3 contains reporting limits for this investigation.

3.3 Laboratory Verification and Validation

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformance with the requirements of the selected analytical methods. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in a case narrative included within the analytical data package.

Data validation criteria are derived from the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 2004) and the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1999). The National Functional Guidelines provide specific data validation criteria that can be applied to data generated for environmental investigations.

Due to the relatively small number of samples proposed for this investigation, the designated WKA Quality Assurance Manager will review the reported laboratory data, in its entirety, for compliance with the following minimal proposed data validation criteria.

Data Completeness

Holding Times Conformance

Achievement of minimum detection levels (MDLs)

Data Qualifiers with attention to non-conformances

Proper preservation

Achievement of minimum detection levels (MDLs)

Laboratory Control Samples

Field Quality Control Samples

Matrix Spike/Matrix Spike Duplicate Recoveries

Surrogates Recoveries

Precision Checks

Compound Identification and Quantification



These criteria correspond in general with a Tier 2 data evaluation, which, in accordance with the USEPA Region 9 *Superfund Data Evaluation/Validation Guidance*, R9QA/006.1 (EPA, 2001), is appropriate for a Brownfields site assessment likely to not require further EPA involvement based on preliminary data.

3.4 Data Management

Measures will be taken to ensure that data are transferred accurately from collection to analysis to reporting. We will manually crosscheck and peer review the data collection and reporting process, including field notes or field data sheets, as well as the data entries from field logs to laboratory reports to the final Findings Report.

3.5 Assessment Oversight

Procedures used to implement quality assurance will include oversight by a designated Quality Assurance Manager (QA Manager). Because this is a limited sampling event, oversight by the QA Manager will be limited to a workplan review and post-sampling event/reporting assessment review as described in the previous section.

4.0 QUALITY CONTROL PROCEDURES

This section presents Quality Control (QC) requirements relevant to analysis of environmental samples that will be followed during all project analytical activities. The purpose of the QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

4.1 Quality Control Procedures

The chemical data to be collected for this effort will be used to determine that the concentration and extent of contamination is adequately evaluated. To that end, it is critical that the chemical data be of sufficient confidence and quality to meet that objective. Consequently, QA/QC procedures will include:

- Adherence to strict protocols for field sampling and decontamination procedures
- Collection and laboratory analysis of appropriate field equipment and container blanks to monitor for contamination of samples in the field
- Collection and laboratory analysis of matrix spike, matrix spike duplicate, and field duplicate samples to evaluate precision and accuracy, and attainment of completeness goals



4.1.1. Equipment Decontamination

Non-dedicated equipment will be decontaminated before and after each sample is collected as described in the SAP.

4.1.2 Standards

Standards, if used for calibration or to prepare samples, will be certified by National Institute of Standards and Technology (NIST), USEPA, or other equivalent source. The standards will be current. The expiration date will be established by the manufacturer, or based on chemical stability, the possibility of contamination, and environmental and storage conditions. Standards will be labeled with expiration dates, and will reference primary standard sources if applicable. Expired standards will be discarded.

4.1.3 Supplies

All supplies will be inspected prior to their use in the field or laboratory. The descriptions for sample collection and analysis contained in the methods will be used as a guideline for establishing the acceptance criteria for supplies. A current inventory and appropriate storage system for these materials will ensure their integrity prior to use. Efficiency and purity of supplies will be monitored through the use of standards and blank samples.

4.1.4 Holding Time Compliance

Sample preparation and analysis will be completed within the required method holding times (see Table 6 and DQIs in Appendices A). Holding time begins at the time of sample collection. If holding times are exceeded, and the analyses are performed, the associated results will be qualified as described in the applicable validation procedure. The following definitions of extraction and analysis compliance are used to assess holding times:

- Preparation or extraction completion – completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup.
- Analysis completion – completion of all analytical runs, including dilutions, second-column confirmations, and any required re-analyses.

4.1.5 Preventive Maintenance

The Field Manager for WKA is responsible for field equipment maintenance as prescribed in the manufacturer's specifications. The analytical laboratory is responsible for all analytical equipment calibration and maintenance as described in their laboratory QA Plan. Subcontractors are responsible for maintenance of all equipment needed to carry out subcontracted duties.



4.2 Quality Assurance and Quality Control (QA/QC) Samples

The purpose of this QA/QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials. QA/QC samples, both field and laboratory, will be collected and analyzed as part of the overall QA/QC program. Table 3 contains a summary of required samples and analyses including the anticipated Field QC samples. Table 5 contains a typical summary of samples required for field and laboratory QC procedures to ensure analytical precision and accuracy.

4.2.1 Field Equipment Blanks

A field equipment blank is a sample that is prepared in the field by pouring de-ionized, distilled water into (or through) cleaned sampling equipment. The water is then collected and analyzed as a sample. Field equipment blanks are typically blind (given a fictitious name so that the laboratory will not recognize it as a blank). The field equipment blank gives an indication of contamination from field procedures (e.g., improperly cleaned sampling equipment, cross-contamination). Field equipment blanks will be collected at a minimum frequency of one per day. The field equipment blanks should be analyzed using the same analyses requested for the associated primary samples collected.

4.2.2 Field Duplicate Samples

Field duplicate samples are collected and analyzed to evaluate sampling and analytical precision. Field duplicates are collected and analyzed in the same manner as the primary samples. Agreement between duplicate sample results will indicate good sampling and analytical precision. Field duplicates of soil samples will be collected at a frequency of at least 10 percent of the primary samples collected during this investigation.

4.2.3 Laboratory Control Sample (LCS)

Laboratory control samples are evaluated to assess overall method performance and are the primary indicators of laboratory performance. In general, laboratory control samples are similar in composition as the environmental samples, contain known concentrations of *all* the analytes of interest, and undergo the same preparatory and determinative procedures as the environmental samples. LCS recoveries are used to measure accuracy. The relative percent difference (RPD) for duplicate LCS recoveries is normally used as a measure of precision.

4.2.4 Matrix Spike Samples

Matrix spikes (MS) are performed by the analytical laboratory to evaluate the efficiency of the sample extraction and analysis procedures, and are necessary because matrix interference (that is,



interference from the sample matrix, water or soil) may have a widely varying impact on the accuracy and precision of the extraction analysis. The matrix spike is prepared by the addition of known quantities of target compounds to a sample. The sample is extracted and analyzed. The results of the analysis are compared with the known additions and a matrix spike recovery is calculated giving an evaluation of the accuracy of the extraction and analysis procedures. Matrix spike recoveries are reviewed to check that they are within acceptable range. However, the acceptable ranges vary widely with both sample matrix and analytical method.

Typically, matrix spikes are performed in duplicate in order to evaluate the precision of the procedures as well as the accuracy. Precision objectives (represented by agreement between matrix spike and matrix spike duplicate (MSD) recoveries) and accuracy objectives (represented by matrix spike recovery results) are based on statistically generated limits established annually by the analytical laboratory. It is important to note that these objectives are to be viewed as goals, not as criteria. If matrix bias is suspected, the associated data will be qualified and the direction of the bias indicated in the data validation report. MS/MSDs will be analyzed by the laboratory at a frequency of at least 5 percent of the field soil and groundwater samples.

A project specific MS/MSD will be performed on one soil sample taken from a random sampling location.

5.0 ANALYTICAL PROCEDURES

The analytical method proposed for this project is EPA Method 7060A. Specific analytical method procedures are detailed in the laboratory QA Plan and standard operating procedures of the selected laboratory. WKA quality assurance staff may review these documents during laboratory audits to ensure that project specifications are met. Laboratory audits are discussed in Section 7.2.

5.1 INTERNAL STANDARDS

Internal standards are measured amounts of method-specified compounds added after preparation, or extraction, of a sample. Internal standards are added to samples, controls, and blanks in accordance with method requirements to identify column injection losses, purging losses, or viscosity effects. Acceptance limits for internal standard recoveries are set forth in the applicable method. If the internal standard recovery falls outside of acceptance criteria, the instrument will be checked for malfunction and reanalysis of the sample will be performed after any problems are resolved.



5.2 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of an analyte, or compound, that can be measured and reported with 99 percent confidence that the concentration is greater than zero. MDLs are established for each method, matrix and analyte, and for each instrument used to analyze project samples. MDLs are derived using the procedures described in 40CFR 136 (USEPA, 1990). USEPA requires that MDLs be established on an annual basis.

5.3 Instrument Calibration

Analytical instruments will be calibrated in accordance with the procedures specified in the applicable method. All analytes that are reported shall be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in the reference method. Records of standard preparation and instrument calibration will be maintained.

Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration records will be traceable to standard materials. At the onset of analysis, instrument calibrations will be checked using all of the analytes of interest. At a minimum, calibration criteria will satisfy method requirements. Analyte concentrations can be determined with either calibration curves or response factors, as defined in the method.

Guidance provided in SW-846 should be considered to determine appropriate evaluation procedures.

6.0 DATA REPORTING

This section presents reporting requirements relevant to the data produced during all project analytical activities.

6.1 Field Data

Data measured by field instruments will be recorded in field notebooks, laptops, and/or on required field forms. Units of measure for field analyses are identified on the field forms. The field data will be reviewed by the Project or Field Manager to evaluate completeness of the field records and appropriateness of the field methods employed. All field records will be retained in the project files.

6.2 Laboratory Data

Analytical data will contain the necessary sample results and quality control data to evaluate the DQOs defined for the project. The laboratory reports will include the following data and summary forms:

Narrative, cross-reference, chain of custody, and method references



Analytical results
Surrogate recoveries (as applicable)
Blank results
Laboratory control sample recoveries
Duplicate sample results or duplicate spike recoveries
Sample spike recoveries
Associated raw data upon request

Data validation criteria are derived from the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 1994b). The *National Functional Guidelines* provide specific data validation criteria that can be applied to data generated for this investigation.

The laboratory data will be reviewed for compliance with the applicable method and the quality of the data reported. The following summarizes the areas of data validation.

Data Completeness
Holding Times
Blanks
Laboratory Control Samples
Matrix Spike/Matrix Spike Duplicates
Surrogates/Internal Standards (as applicable);
Field Quality Control Samples
Compound Identification and Quantification

The application of data validation criteria is a function of project-specific DQOs. The QA Manager will determine if the data quality objectives for the analytical data have been met. Results of the data validation review will be documented and detailed in a Data Validation Memorandum, which is reported along with the associated data.

6.3 Procedures for Data Validation

Guidance for performing data validation for the types of analyses to be utilized for this investigation is provided in the *National Functional Guidelines*. Data validation will be documented in a manner generally conforming to these functional guidelines.



6.4 Data Qualifiers

The data validation procedures were designed to review each data set and identify biases inherent to the data and determine its usefulness. Data validation flags are applied to those sample results that fall outside of specified tolerance limits, and, therefore, did not meet the program's quality assurance objectives. Data validation flags to be used for this project are defined in the *National Functional Guidelines*. Data validation flags will indicate if results are considered anomalous, estimated, or rejected. Only rejected data are considered unusable for decision-making purposes; however, other qualified data may require further verification.

7.0 PERFORMANCE AND SYSTEM AUDITS

Audit programs are established and directed by the WKA quality assurance staff to ensure that field and laboratory activities are performed in compliance with project controlling documents. This section describes responsibilities, requirements and methods for scheduling, conducting and documenting audits of field and laboratory activities.

7.1 Field Audits

Field audits focus on appropriateness of personnel assignments and expertise, availability of field equipment, adherence to project controlling documents for sample collection and identification, sample handling and transport, use of QA samples, chain of custody procedures, equipment decontamination and documentation. Field audits are not required, but may be performed in the event significant discrepancies are identified that warrant evaluation of field practices.

7.2 Laboratory Audits

Laboratory audits include reviews of sample handling procedures, internal sample tracking, analytical data documentation, QA/QC protocols, and data reporting. CLS, the selected laboratory for the proposed RAW, is licensed by the State of California as a certified testing laboratory, and routinely participates in a California Department of Health Services (CADOHS) approved Performance Evaluation Program for hazardous waste and wastewater analyses. If no previous audit has been conducted by WKA, the quality assurance staff may conduct a scheduled audit during the course of this project to ensure the integrity of sample handling and processing by the laboratory.

7.3 Data Audits

Data audits will be performed on analytical results received from the laboratory. Data audits are accomplished through the process of data validation as referenced in Section 6.3. If warranted based on the findings of the validation described above, the laboratory may be required to submit complete raw data files to WKA for validation and verification. WKA data quality staff, or



qualified subcontractor, will perform a review of the data consistent with the level of effort described in the *National Functional Guidelines*. This level of validation consists of a detailed review of sample data, including verification of data calculations for calibration and quality control samples to assess if these data are consistent with method requirements. Upon request, the laboratory will make available all supporting documentation in a timely fashion.

7.4 Scheduling

Audits will be scheduled such that field and laboratory activities are adequately monitored, or in the event discrepancies are identified. The overall frequency of audits conducted for these activities will be based on the importance and duration of work, as well as significant changes in project scope or personnel.

7.5 Reports to Management and Responsibilities

Upon completion of any audit, the auditor will submit to the Project and Field Manager a report or memorandum describing any problems or deficiencies identified during the audit. It is the responsibility of the Project Manager to determine if the deviations will result in any adverse effect on the project conclusions. If it is determined that corrective action is necessary, procedures outlined in Section 7.6 will be followed.

7.6 Corrective Action

Corrective actions will be initiated whenever data quality indicators suggest that DQOs have not been met. Corrective actions will begin with identifying the source of the problem. Potential problem sources include failure to adhere to method procedures, improper data reduction, equipment malfunctions, or systemic contamination. The first level of responsibility for identifying the problems and initiating corrective action lies with the analyst/field personnel. The second level of responsibility lies with any person reviewing the data. Corrective actions may include more intensive staff training, equipment repair followed by a more intensive preventive maintenance program, or removal of the source of systemic contamination. Once resolved, the corrective action procedure will be fully documented, and if DQOs were not met, the samples in question must be recollected and/or reanalyzed utilizing a properly functioning system.



8.0 REFERENCES

- WKA, 2006a. *Preliminary Endangerment Assessment; Proposed Plumas Ranch Elementary School Site*. February 15.
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- USEPA, 1990. Code of Federal Regulations, Title 40 – Protection of Environment. Office of the Federal Register. U.S. National Archives and Records Administration, Washington, D.C.
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APPENDIX F-A

EPA REGION 9

QUALITY CONTROL ACCEPTANCE CRITERIA

LABORATORY SPECIFIC

STANDARD OPERATING PROCEDURES



ARSENIC (ATOMIC ABSORPTION, FURNACE TECHNIQUE)

1.0 SCOPE AND APPLICATION

1.1 Method 7060 is an atomic absorption procedure approved for determining the concentration of arsenic in wastes, mobility procedure extracts, soils, and ground water. All samples must be subjected to an appropriate dissolution step prior to analysis.

2.0 SUMMARY OF METHOD

2.1 Prior to analysis by Method 7060, samples must be prepared in order to convert organic forms of arsenic to inorganic forms, to minimize organic interferences, and to convert the sample to a suitable solution for analysis. The sample preparation procedure varies depending on the sample matrix. Aqueous samples are subjected to the acid digestion procedure described in this method. Sludge samples are prepared using the procedure described in Method 3050.

2.2 Following the appropriate dissolution of the sample, a representative aliquot of the digestate is spiked with a nickel nitrate solution and is placed manually or by means of an automatic sampler into a graphite tube furnace. The sample aliquot is then slowly evaporated to dryness, charred (ashed), and atomized. The absorption of hollow cathode or EDL radiation during atomization will be proportional to the arsenic concentration. Other modifiers may be used in place of nickel nitrate if the analyst documents the chemical and concentration used.

2.3 The typical detection limit for water samples using this method is 1 ug/L. This detection limit may not be achievable when analyzing waste samples.

3.0 INTERFERENCES

3.1 Elemental arsenic and many of its compounds are volatile; therefore, samples may be subject to losses of arsenic during sample preparation. Spike samples and relevant standard reference materials should be processed to determine if the chosen dissolution method is appropriate.

3.2 Likewise, caution must be employed during the selection of temperature and times for the dry and char (ash) cycles. A matrix modifier such as nickel nitrate must be added to all digestates prior to analysis to minimize volatilization losses during drying and ashing.

3.3 In addition to the normal interferences experienced during graphite furnace analysis, arsenic analysis can suffer from severe nonspecific absorption and light scattering caused by matrix components during atomization. Arsenic analysis is particularly susceptible to these problems because of its low analytical wavelength (193.7 nm). Simultaneous background correction must be employed to avoid erroneously high results. Aluminum is a severe positive interferent in the analysis of arsenic, especially using D₂ arc background

correction. Although Zeeman background correction is very useful in this situation, use of any appropriate background correction technique is acceptable.

3.4 If the analyte is not completely volatilized and removed from the furnace during atomization, memory effects will occur. If this situation is detected by means of blank burns, the tube should be cleaned by operating the furnace at full power at regular intervals in the analytical scheme.

4.0 APPARATUS AND MATERIALS

4.1 Griffin beaker or equivalent: 250 mL.

4.2 Class A Volumetric flasks: 10-mL.

4.3 Atomic absorption spectrophotometer: Single or dual channel, single- or double-beam instrument having a grating monochromator, photo-multiplier detector, adjustable slits, a wavelength range of 190 to 800 nm, and provisions for simultaneous background correction and interfacing with a suitable recording device.

4.4 Arsenic hollow cathode lamp, or electrodeless discharge lamp (EDL): EDLs provide better sensitivity for arsenic analysis.

4.5 Graphite furnace: Any graphite furnace device with the appropriate temperature and timing controls.

4.6 Data systems recorder: A recorder is strongly recommended for furnace work so that there will be a permanent record and so that any problems with the analysis such as drift, incomplete atomization, losses during charring, changes in sensitivity, etc., can easily be recognized.

4.7 Pipets: Microliter with disposable tips. Sizes can range from 5 to 1,000 μ L, as required.

5.0 REAGENTS

5.1 Reagent water: Water should be monitored for impurities. All references to water will refer to reagent water.

5.2 Concentrated nitric acid: Acid should be analyzed to determine levels of impurities. If a method blank using the acid is <MDL, the acid can be used.

5.3. Hydrogen peroxide (30%): Oxidant should be analyzed to determine levels of impurities. If a method blank using the H_2O_2 is <MDL, the reagent can be used.

5.4 Arsenic standard stock solution (1,000 mg/L): Either procure a certified aqueous standard from a supplier and verify by comparison with a second standard, or dissolve 1.320 g of arsenic trioxide (As_2O_3 , analytical reagent grade) or equivalent in 100 mL of reagent water containing 4 g NaOH. Acidify the solution with 20 mL concentrated HNO_3 and dilute to 1 liter (1 mL = 1 mg As).

5.5 Nickel nitrate solution (5%): Dissolve 24.780 g of ACS reagent grade $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ or equivalent in reagent water and dilute to 100 mL.

5.6 Nickel nitrate solution (1%): Dilute 20 mL of the 5% nickel nitrate to 100 mL with reagent water.

5.7 Arsenic working standards: Prepare dilutions of the stock solution to be used as calibration standards at the time of the analysis. Withdraw appropriate aliquots of the stock solution, add concentrated HNO_3 , 30% H_2O_2 , and 5% nickel nitrate solution or other appropriate matrix modifier. Amounts added should be representative of the concentrations found in the samples. Dilute to 100 mL with reagent water.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must have been collected using a sampling plan that addresses the considerations discussed in Chapter Nine of this manual.

6.2 All sample containers must be prewashed with detergents, acids, and reagent water. Plastic and glass containers are both suitable.

6.3 Special containers (e.g., containers used for volatile organic analysis) may have to be used if very volatile arsenic compounds are to be analyzed.

6.4 Aqueous samples must be acidified to a pH of <2 with nitric acid and refrigerated prior to analysis.

6.5 Although waste samples do not need to be refrigerated sample handling and storage must comply with the minimum requirements established in Chapter One.

7.0 PROCEDURE

7.1 Sample preparation: Aqueous samples should be prepared in the manner described in Paragraphs 7.1.1-7.1.3. Sludge-type samples should be prepared according to Method 3050A. The applicability of a sample-preparation technique to a new matrix type must be demonstrated by analyzing spiked samples and/or relevant standard reference materials.

7.1.1 Transfer a known volume of well-mixed sample to a 250-mL Griffin beaker or equivalent; add 2 mL of 30% H_2O_2 and sufficient concentrated HNO_3 to result in an acid concentration of 1% (v/v). Heat, until digestion is complete, at 95°C or until the volume is slightly less than 50 mL.

7.1.2 Cool, transfer to a volumetric flask, and bring back to 50 mL with reagent water.

7.1.3 Pipet 5 mL of this digested solution into a 10-mL volumetric flask, add 1 mL of the 1% nickel nitrate solution or other appropriate matrix modifier, and dilute to 10 mL with reagent water. The sample is now ready for injection into the furnace.

7.2 The 193.7-nm wavelength line and a background correction system are required. Follow the manufacturer's suggestions for all other spectrophotometer parameters.

7.3 Furnace parameters suggested by the manufacturer should be employed as guidelines. Because temperature-sensing mechanisms and temperature controllers can vary between instruments or with time, the validity of the furnace parameters must be periodically confirmed by systematically altering the furnace parameters while analyzing a standard. In this manner, losses of analyte due to overly high temperature settings or losses in sensitivity due to less than optimum settings can be minimized. Similar verification of furnace parameters may be required for complex sample matrices.

7.4 Inject a measured microliter aliquot of sample into the furnace and atomize. If the concentration found is greater than the highest standard, the sample should be diluted in the same acid matrix and reanalyzed. The use of multiple injections can improve accuracy and help detect furnace pipetting errors.

8.0 QUALITY CONTROL

8.1 Refer to section 8.0 of Method 7000.

9.0 METHOD PERFORMANCE

9.1 Precision and accuracy data are available in Method 206.2 of Methods for Chemical Analysis of Water and Wastes.

9.2 The optimal concentration range for aqueous samples using this method is 5-100 ug/L. Concentration ranges for non-aqueous samples will vary with matrix type.

9.3 The data shown in Table 1 were obtained from records of state and contractor laboratories. The data are intended to show the precision of the combined sample preparation and analysis method.

10.0 REFERENCES

1. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-82-055, December 1982, Method 206.2.

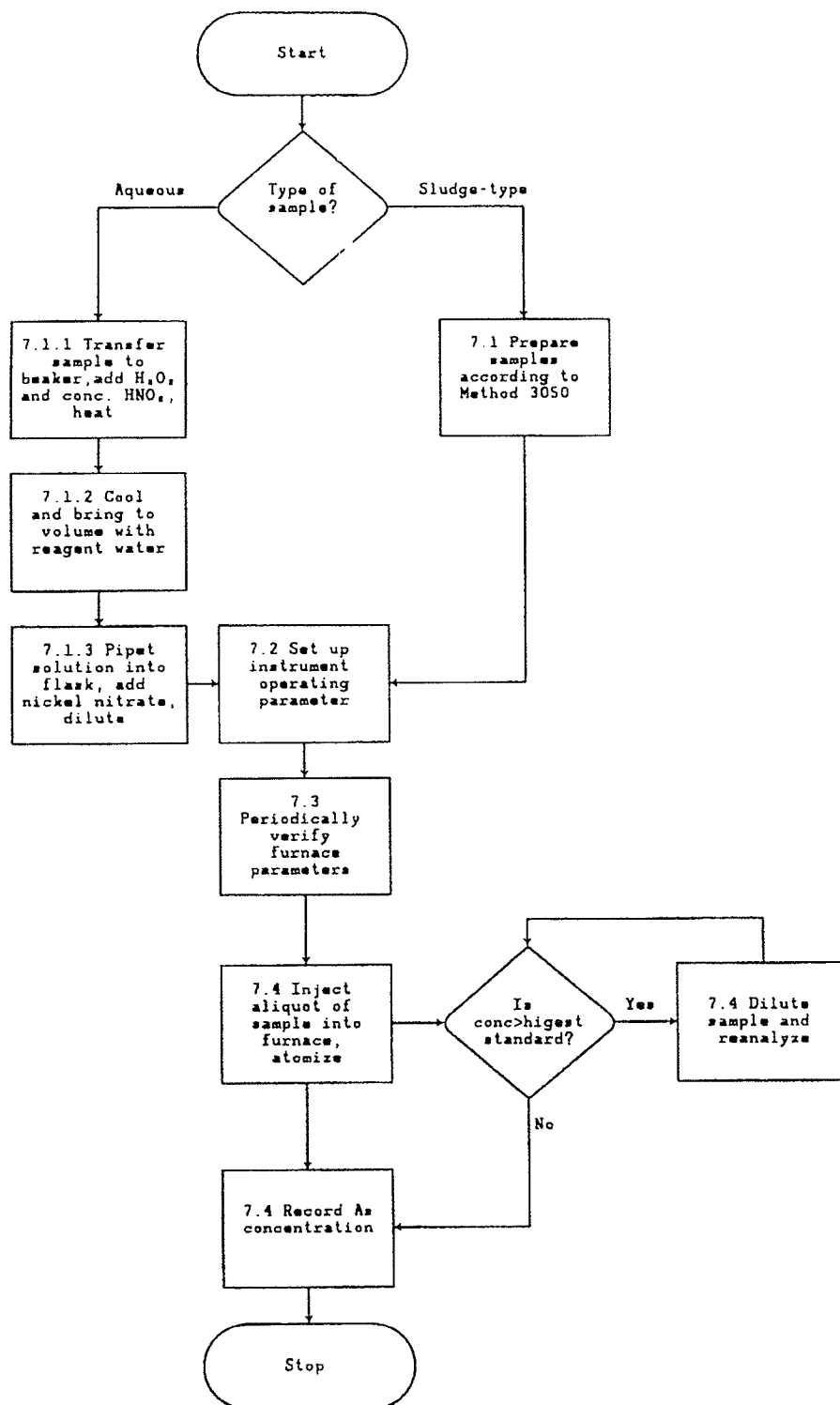
2. Gaskill, A., Compilation and Evaluation of RCRA Method Performance Data, Work Assignment No. 2, EPA Contract No. 68-01-7075, September 1986.

TABLE 1. METHOD PERFORMANCE DATA

Sample Matrix	Preparation Method	Laboratory Replicates
Contaminated soil	3050	2.0, 1.8 ug/g
Oily soil	3050	3.3, 3.8 ug/g
NBS SRM 1646 Estuarine sediment	3050	8.1, 8.33 ug/g ^a
Emission control dust	3050	430, 350 ug/g

^aBias of -30 and -28% from expected, respectively.

METHOD 7060A
ARSENIC (ATOMIC ABSORPTION, FURNACE TECHNIQUE)





Title: Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Method 6010B, Trace Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)

WSC – CAM – III A

Quality Assurance and Quality Control Requirements and Performance Standards for **SW-846 Method 6010B, Trace Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)** for the Massachusetts Contingency Plan (MCP)

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Title: Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Method 6010B, Trace Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)

III Trace Metal Analyses

A. QA/QC Requirements and Performance Standards for SW-846 Method 6010B, Trace Metals by ICP-AES

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Title: Quality Assurance and Quality Control Requirements and Performance Standards for SW-846 Method 6010B, Trace Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)

1.0 QA/QC Requirements for SW-846 Method 6010B

1.1 Method Overview

Inductively coupled plasma-atomic emission spectrometry (ICP-AES) determines trace elements, including metals, in solution. The method is applicable for all of the analytes listed in Section 2.4 as well as numerous other elements (refer to Table 1, SW-846 Method 6010B). All matrices, excluding filtered groundwater samples but including ground water, aqueous samples, TCLP and EP extracts, industrial and organic wastes, soils, sludges, sediments, and other solid wastes, require digestion prior to analysis. Groundwater samples that have been pre-filtered and acidified do not require acid digestion. Samples that are not digested must either use an internal standard or be matrix matched with the standards. Refer to Chapter 3.0, SW-846 Method 6010B for the appropriate digestion procedures.

1.1.1 Reporting Limits for SW-846 Method 6010B

Reporting Limits (RL), sensitivity, and the optimum and linear concentration ranges of the analytes can vary with the wavelength, spectrometer, matrix and operating conditions. Table 1, SW-846 Method 6010B lists the recommended analytical wavelengths and estimated instrumental detection limits (IDLs) for numerous elements, including all analytes listed in Section 2.4, in clean aqueous matrices. Elements and matrices other than those listed in Table 1, SW-846 Method 6010B may be analyzed by this method if performance at the concentration ranges of interest (see Section 8.0, SW-846 Method 6010B) is demonstrated.

Sample preservation, container and analytical holding time specifications for surface water, groundwater, soil, and sediment matrices for trace metals analyzed in support of MCP decision-making are presented in Appendix III A-1 of this document and Appendix VII-A, WSC-CAM-VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data in Support of Response Actions Conducted Under the Massachusetts Contingency Plan (MCP)".

1.1.2 General Quality Control Requirements of SW-846 Method 6010B

Each laboratory that uses SW-846 Method 6010B is required to operate a formal quality assurance program to demonstrate the precision and bias of the method as performed by the laboratory and procedures for determining the method reporting limit (RL). The minimum requirements of this program consist of an initial demonstration of laboratory proficiency, ongoing analysis of standards and blanks as a test of continued performance, and the analysis of laboratory control samples (LCSs), and LCS duplicates to assess accuracy and/or precision. Project-specific matrix duplicates or matrix spike duplicates (MSDs) may be used in lieu of LCS duplicates to evaluate precision when such samples are analyzed either at discretion of laboratory or at request of data-user.

Laboratories must document and have on file an Initial Demonstration of Proficiency for each combination of sample preparation and determinative method being used. These data must



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meet or exceed the performance standards as presented in Section 1.4 and Table III A-1 of this method. Procedural requirements for performing the Initial Demonstration of Proficiency can be found in SW-846 Chapter One, Section 4.4.1 and SW-846 Method 6010B, Section 8.0. The data associated with the Initial Demonstration of Proficiency must be kept on file at the laboratory and made available to potential data-users on request. The data associated with the Initial Demonstration of Proficiency for SW-846 Method 6010B must include the following:

QC Element	Performance Criteria
Initial Calibration	WSC-CAM-III A, Table III A-1
Continuing Calibration	WSC-CAM-III A, Table III A-1
Method Blanks	WSC-CAM-III A, Table III A-1
% Percent Recovery for MS/LCS	WSC-CAM-III A, Table III A-1
Relative Percent Difference (RPD) for MSD/LCS Duplicate	WSC-CAM-III A, Table III A-1
Other Instrument QC Samples	WSC-CAM-III A, Table III A-1

It is essential that laboratory-specific performance criteria for LCS, LCS duplicates (or project-specific matrix duplicates or matrix spike duplicates, see Table III A-1) and the other data quality indicators, listed in Table III A-1, also be calculated and documented. When experience indicates that the criteria recommended in specific methods are frequently not met for some analytes and/or matrices, the in-house performance criteria will be a means of documenting these repeated exceedances. Laboratories are encouraged to actively monitor pertinent quality control performance standards described in Table III A-1 to assess analytical trends (i.e., systematic bias, etc) and to improve overall method performance.

For SW-846 Method 6010B, laboratory-specific control limits must meet or exceed (demonstrate less variability than) the performance standards for each QC element listed on Table III A-1. It should be noted that the performance standards listed in Table III A-1 are based on multiple-laboratory data, which are in most cases expected to demonstrate more variability than performance standards developed by a single laboratory. Laboratories are encouraged to continually strive to minimize variability and improve the accuracy and precision of their analytical results. The data user will utilize this analytical performance data to verify that the results reported by the laboratory are consistent with the pre-established data quality objectives for the MCP disposal site.

This method is restricted to use by, or under the supervision of spectroscopists who are knowledgeable in the correction of spectral, chemical, and physical interferences described in this method.

1.2 Summary of Method

Solubilized or digested samples are nebulized and the resulting aerosol is transported to the plasma torch using an argon gas carrier. The resulting multi-element emissions produced by a radio-frequency inductively coupled plasma are resolved into its component radiation (wavelengths) by a grating spectrometer. The light emitted by the atoms or ions in the ICP is



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converted to electrical signals by the photomultiplier in the spectrometer. The intensity of the electron signal is compared to previous measured intensities of known concentration of the element and a concentration is computed.

Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line.

For environmental applications, an ICP-AES typically incorporates sequential or simultaneous optical systems and axial or radial viewing of the plasma for multi-elemental determinations.

1.2.1 Sample Preparation

Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods as described in Chapter 3.0, SW-846 Method 6010B and summarized in Appendix III A-1, Sample Preservation, Container and Analytical Holding Time Specifications for Surface Water, Groundwater, Soil and Sediment Samples Analyzed for Metals by ICP-AES in Support of MCP Decision Making. When analyzing groundwater samples for dissolved constituents, acid digestion is not necessary if the samples are filtered and acid preserved prior to analysis.

1.3 Method Interferences

Types of interference and approaches for minimizing their adverse effects are described in detail in Section 3.0, SW-846 Method 6010B, and summarized herein. Tests for the evaluation of potential method interferences are also described in Section 8.5, SW-846 Method 6010B. Types of interferences on ICP include:

- Spectral interferences (described in Section 3.1 of SW-846 Method 6010B) – caused by background emission, stray light from high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra. Common spectral interferants, which cause suppression or enhancement of other analytes present in a sample, include aluminum, calcium, iron, and magnesium (though other analytes can also contribute to spectral interference and should be monitored – see Table 2 of SW-846 Method 6010B for a list of 21 potential interelement interferents and the analytes that they affect). Spectral interferences are minimized by using background corrections and interelement corrections, which can be applied either automatically by the ICP data system or manually by the spectroscopist. It is strongly recommended that automatic (computerized) corrections for both background and interelement interferences be utilized during analysis of all MCP samples. If not, the laboratory must narrate how spectral interferences were minimized and what hand-calculations, if any, were performed to correct sample results. In all cases, the acceptable analysis of interference check samples (ICSA and ICSAB, see Table III A-1 for acceptance criteria) provides evidence of acceptable background and interelement corrections.



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- Physical interferences (described in Section 3.2 of SW-846 Method 6010B) – caused by sample viscosity and surface tension affection the sample nebulization. Samples with high dissolved solids or high acid content can exhibit physical interference. Physical interferences can be minimized by diluting the sample, using an internal standard, or using a high solids nebulizer to introduce the sample to the ICP. The common use of mass flow controllers also minimizes the effects of physical interferences and improves ICP performance.
- Chemical interferences (described in Section 3.3 of SW-846 Method 6010B) – molecular compound formation, ionization effects, and solute vaporization. Chemical interferences are uncommon in the analysis of samples by ICP.
- Memory interferences (described in Section 3.4 of SW-846 Method 6010B)- caused by a high concentration sample contributing to signal of subsequent sample. Optimizing rinse times between sample analyses (including both field and QC samples) will minimize the potential for memory interferences.
- High salt concentrations (described in Section 3.5 of SW-846 Method 6010B) – cause analyte signal suppression (e.g., seawater samples). Samples with high salt content can cause both physical interference, by salting-over the torch, and significant suppression of analyte response in the sample. Samples should be diluted to bring the sodium (and other analytes) within the linear range of the instrument; note, however, this approach may raise the sample-specific reporting limit for analytes of interest above the MCP requirements. Therefore, it is recommended that alternate preparation/extraction methods be used to remove the salt interference prior to ICP analysis.

1.4 Quality Control Requirements for SW-846 Method 6010B

1.4.1 General Quality Control Requirements for Determinative Inorganic Methods

Refer to SW-846 Chapter One for general quality control procedures for all inorganic methods, including SW-846 Method 6010B. These requirements ensure that each laboratory maintain a formal quality assurance program and records to document the quality of all inorganic data.

Quality Control procedures necessary to evaluate the instrument's operation may be found in Chapter One, Section 2.0, and include evaluation of calibrations and performance of sample analyses.

Instrument quality control and method performance requirements for the ICP-AES system may be found in SW-846 Method 6010B, Sections 8.0 and 9.0, respectively.

1.4.2 Specific QA/QC Requirements and Performance Standards for SW-846 Method 6010B

Specific QA/QC requirements and performance standards for SW-846 Method 6010B are presented in Table III A-1. Strict compliance with the QA/QC requirements and performance standards for this method, as well as satisfying other analytical and reporting requirements will provide a data user with "Presumptive Certainty" regarding the usability of analytical data to



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support MCP decisions. The concept of "Presumptive Certainty" is explained in detail in Section 2.0 of WSC-CAM-VII A.

While optional, parties electing to utilize these protocols will be assured of "Presumptive Certainty" of data acceptance by agency reviewers. In order to achieve "Presumptive Certainty", parties must:

- (a) Comply with the procedures described and referenced in WSC-CAM-III A;
- (b) Comply with the applicable QC analytical requirements prescribed in Table III A-1 for this test procedure;
- (c) Evaluate, and narrate, as necessary, compliance with performance standards prescribed in Table III A-1 for this test method; and
- (d) Adopt the reporting formats and elements specified in the CAM

In achieving the status of "Presumptive Certainty", parties will be assured that analytical data sets:

- ✓ Will satisfy the broad QA/QC requirements of 310 CMR 40.0017 and 40.0191 regarding the scientific defensibility, precision and accuracy, and reporting of analytical data;
- ✓ May be used in a data usability assessment, and if in compliance with all MCP Analytical Method standards, laboratory QC requirements, and field QC recommended limits and action levels, the data set will be considered useable data to support site characterization decisions made pursuant to the MCP; and
- ✓ May be used to help support a data representativeness assessment.

Widespread adherence to the "Presumptive Certainty" approach will promote inter-laboratory consistency and provide the regulated community with a greater degree of certainty regarding the quality of data used for MCP decision-making. The issuance of these requirements and standards is in no way intended to preempt the exercise of professional judgement by the LSP in the selection of alternative analytical methods. However, parties who elect not to utilize the "Presumptive Certainty" option have an obligation, pursuant to 310 CMR 40.0017 and 40.0191(2)(c), to demonstrate and document an overall level of (laboratory and field) QA/QC, data usability, and data representativeness that is adequate for and consistent with the intended use of the data.



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Table: III A-1

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Title: **Table III A-1 Specific QA/QC Requirements and Performance Standards for SW-846 Method 6010B**

Required QA/QC	Data Quality Objective	Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Initial Calibration	Laboratory Analytical Accuracy	(1) Frequency - Daily following profiling and optimization of ICP and prior to sample analysis (2) Minimum of a calibration blank plus one calibration standard for each analyte (may be mixed-analyte solutions). (3) Linear curve fit with correlation coefficient $r > 0.995$. Second order curve fit may be used if $r > 0.995$.	No	Re-optimize instrument set up; re-calibrate as required by method.	Linear curve criteria applicable to calibration curves with one blank and 2 or more calibration standards.
Initial Calibration Verification (ICV)	Laboratory Analytical Accuracy	(1) Frequency - Daily immediately after initial calibration (2) Separate-source from calibration standards (3) ICV % recovery must be 90-110%; RSD < 5% for the replicate (minimum of 2) integrations.	No	Re-calibrate/Re-analyze ICV as required by method	Suspend all analyses until Initial Calibration non-conformance is rectified.
Initial Calibration Blank (ICB)	Laboratory Analytical Sensitivity (instrument drift and contamination evaluation)	(1) Frequency - Daily immediately after ICV (2) Must be matrix-matched (the same concentration of acids as standards and samples) (3) ICB must be < Reporting Limit (RL)	No	Re-calibrate/Re-analyze ICB as required by method	
Low Level Calibration Check Standard	Laboratory Analytical Sensitivity (to support the RL)	Only required if NOT including the RL as the low-level standard in the calibration curve. (1) Frequency - Daily prior to field sample analysis (2) Check Standard at the level of the RL for all analytes (3) % recovery recommended 70-130%	No	Re-calibrate / narrate	This is a MADEP-MCP required performance standard. However, it is not required if the RL is supported by a low-level standard in the initial calibration. Narrate non-compliance.
Continuing Calibration Verification (CCV)	Laboratory Analytical Accuracy	(1) Frequency - Every 10 samples and at end of run (2) Same-source as calibration standards; near mid-point of linear range (3) CCV % recovery must be 90-110%; RSD < 5% for the replicate (minimum of 2) integrations.	No	Re-calibrate/Re-analyze all samples since last compliant CCV.	Narrate non-compliance.



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Required QA/QC	Data Quality Objective	Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Continuing Calibration Blank (CCB)	Laboratory Analytical Sensitivity (instrument drift and contamination evaluation)	(1) Frequency - Every 10 samples and at end of run immediately after CCV (2) Must be matrix-matched (the same concentration of acids as standards and samples) (3) CCB must be < RL	No	Re-calibrate/Re-analyze all samples since last compliant CCB.	Narrate non-compliance.
Interference Check Standards (ICS A and ICSAB)	Laboratory Analytical Accuracy	(1) Frequency - Daily prior to field sample analysis and at end of run. (2) ICS A and ICSAB contain known amounts of interferants and analytes (see method) (3) ICSA/AB % recoveries for all analytes must be 80-120%	No	May require adjustment of interference corrections, background corrections, and/or linear ranges.	Narrate non-compliance.
Method (Preparation) Blank	Laboratory Method Sensitivity (contamination evaluation)	(1) Frequency - One per digestion batch of < 20 field samples. If samples undigested (dissolved metals) the ICB = method blank. (2) Must be matrix-matched (the same concentration of acids as calibration and QC standards) and digested with the samples (3) Method Blank must be < RL	Yes	Re-digest/Re-analyze all associated samples unless all detected results are > 10x method blank level.	Narrate non-compliance.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	(1) Frequency - One per digestion batch of < 20 field samples. If samples are undigested (dissolved metals) an ICV = LCS. (2) LCS must be matrix-matched to samples (aqueous/solid) and digested with the samples (3) LCS % recoveries for all analytes must be 80-120% for aqueous media and vendor control limits (95% confidence limits) for solids.	Yes	Re-digest/Re-analyze all associated samples.	Narrate non-compliance.



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Required QA/QC	Data Quality Objective	Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
LCS Duplicate	Laboratory Method Precision	(1) Frequency - One per digestion batch of ≤ 20 field samples. If samples are undigested (dissolved metals) an ICV duplicate may be substituted for an LCS duplicate. (2) Prepared using same standard source and concentration as LCS. (3) Recommended to be run immediately after LCS in analytical sequence. (4) LCS duplicate must be matrix-matched to samples (aqueous/solid) and digested with the samples (5) Laboratory-determined Relative Percent Difference (RPD) must be ≤ 20 (aqueous) and ≤ 30 (solids), and (6) A project-specific MD or MSD may be substituted to evaluate precision in lieu of an LCS duplicate.	Yes	Recalculate RPD; Locate source of problem; Narrate non-conformances	(1) Locate and rectify source of non-conformance before proceeding with the analyses of subsequent sample batches. (2) Narrate non-conformances
Project-specific Matrix Spike Sample (MS)	Method Accuracy in Sample Matrix	(1) Frequency - One per digestion batch of < 20 field samples if <u>requested by data-user</u> (see Appendix III A-2 for required matrix frequency) . <u>If samples are undigested (dissolved metals) perform an analytical spike.</u> (2) MS % recoveries for all analytes 75-125% for all media (recommended).	Yes Only when requested by the data-user	If MS % recovery is $> 30\%$, and LCS was in-control, no corrective action is required. If MS %recovery is $< 30\%$, and non-detected results were found, one or more of the following may be performed to confirm matrix effect: 1) homogenize sample well, re-digest, and re-analyze sample/MS; 2) perform method of standard additions for quantitation; 3) perform serial dilution; 4) perform post-digestion spike.	Narrate non-compliance. Note to data users: USEPA Region I data validation guidance requires rejection of non-detected results with MS $< 30\%$ recovery. Therefore, the 1st corrective action listed may be required for critical sample data to obtain usable results.



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Required QA/QC	Data Quality Objective	Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Project-specific Matrix Duplicate Sample (MD) or Matrix Spike Duplicate (MSD)	Method Precision in Sample Matrix	(1) Frequency - One per digestion batch of < 20 field samples, at discretion of laboratory or at request of data-user <u>If samples are undigested (dissolved metals) perform an analytical duplicate.</u> (2) MD: Prepared by digesting and analyzing an additional aliquot of a field sample. (3) MSD: Prepared by fortifying an additional aliquot of the field sample used for MS. (4) MD relative percent difference (RPD): aqueous results > 5x RL: $\pm 20\%$; aqueous results < 5x RL difference \leq RL; solid results > 5x RL: $\pm 35\%$; solid results < 5x RL : difference $\leq 2x$ RL.	Yes Only when requested by the data-user	Check LCS; if recoveries acceptable in LCS, narrate nonconformance.	Note exceedances in Environmental Laboratory case narrative.
Linear Range Analysis	Laboratory Analytical Accuracy	(1) Frequency - Annually for most metals, every 6 months for those metals that periodically approach the upper limit. (2) Determine the upper limit of the linear dynamic range for each wavelength utilized by determining the signal responses from a minimum of 3 (preferably 5) different concentration standards across the range, see method for details.	No	Not applicable.	See method for requirements. Data must be kept on file to document initial demonstration of performance (IDP) of linear range analysis for each ICP instrument.
Inter-element Spectral Interference Correction Analysis	Laboratory Analytical Accuracy	(1) Frequency - Inter-element spectral corrections must be verified every 6 months. (2) Routine analysis of ICSA and ICSAB verifies inter-element spectral interference corrections. (3) See method for details.	No	Not applicable.	See method for requirements. Data must be kept on file to document initial demonstration of performance (IDP) of interelement correction factors/equations and background correction points for each ICP instrument.



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Title: **Table III A-1 Specific QA/QC Requirements and Performance Standards for SW-846 Method 6010B**

Required QA/QC	Data Quality Objective	Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
General Reporting	NA	(1) Non detected values must be reported with the sample-specific reporting limit for each ICP analyte. (2) The RL must be \leq the applicable regulatory compliance standard for each metal reported (3) The RL must be verified at least daily with a low-level calibration check standard following the calibration curve or supported by the low-level standard in the calibration curve. (4) Results for soils/sediments must be reported on a dry weight basis for comparison to MCP regulatory standards (5) Sample concentrations that exceed the highest calibration standard must be diluted (in the same acid matrix) to fall within the calibration range when reanalyzed	Yes	Not applicable.	



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1.5 List of Analytes for SW-846 Method 6010B

The MCP analyte list for SW-846 Method 6010B presented in Table III A-2, is intended to be protective of human health and the environment and the Commonwealth's groundwater resources. The list is comprised of potential toxic metal contaminants that are readily-analyzable by SW-846 Method 6010B and have a Method 1 Groundwater/Soil Standards as described in 310 CMR 40.0974

The MCP Method 1 Groundwater/Soil Standards used to characterize the risk of harm posed by oil or hazardous materials at a disposal site are described in 310 CMR 40.0974(2), Table 1. This list of groundwater/soil standards, developed by the Department, takes into account a defined set of conservative potential exposure pathways likely to be encountered at most disposal sites. Method 1 Standards have been developed by the Department for over one hundred organic and inorganic contaminants that are commonly encountered at MCP disposal sites. The MCP Method 1 Groundwater/Soil Standards list is periodically reviewed and updated by the Department. When compounds are added to the MCP Method 1 Groundwater/Soil Standards list that are suitable for analysis by SW-846 Method 6010B, the analyte list for this method will be updated accordingly.

1.6 Additional Analyte Reporting Requirements for SW-846 Method 6010B

1.6.1 Analysis and Reporting recommendations for SW-846 Method 6010B

While it is not necessary to request and report all the SW-846 Method 6010B analytes listed in Table III A-2 to obtain Presumptive Certainty, it is necessary to document such a limitation, for site characterization and data representativeness considerations. DEP strongly recommends use of the full analyte list during the initial stages of site investigations, and/or at sites with an unknown or complicated history of uses of oil or hazardous materials. These assessment activities may include but are not limited to:

- ✓ Immediate Response Actions (IRAs) performed in accordance with 310 CMR 40.0410;
- ✓ Initial Site Investigation Activities performed in accordance with 310 CMR 40.0405(1);
- ✓ Phase I Initial Site Investigation Activities performed in accordance with 310 CMR 40.0480 through 40.0483; and
- ✓ Phase II Comprehensive Site Investigation Activities performed in accordance with 310 CMR 40.0830

In a limited number of cases, the use of the full analyte list for a chosen analytical method may not be necessary, with respect to data representativeness concerns, including:

- ✓ Uncharacterized sites where substantial site/use history information is available to rule-out all but a limited number of contaminants of concern, and where use of the full analyte list would significantly increase investigative costs; or



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- ✓ Well-characterized sites where initial full-analyte list testing efforts have sufficiently narrowed the list of contaminants of concern.

Note that a desire to avoid detection and quantitation of a contaminant that is present or likely present at a site above background levels is not a valid reason to limit an analyte list, and that such an action could constitute a criminal violation of MGL c. 21E.

In cases where a truncated list of method analytes is selected, laboratories must still employ the method-specific quality control requirements and performance standards associated with the requested analytes list to obtain Presumptive Certainty status.

1.6.2 Elements Used to Evaluate Inter-Element Spectral Interferences

Elements not listed in Table III A-2 and identified and quantified in the course of SW-846 Method 6010B analysis of field samples to evaluate inter-element spectral interferences, etc., need not be reported as contaminants.

1.6.3 Special Analytical and Reporting Considerations for Mercury

Because of its elevated Estimated Instrumental Detection Limit (Table 1, SW-846 Method 6010B) Mercury, a common environmental contaminant, is not included on Table III A-2, Analyte List for SW-846 Method 6010B.

Although Mercury is not required to be reported to obtain "Presumptive Certainty" status for SW-846 Method 6010B, it must be given consideration as a contaminant of concern when sites with unknown, uncertain or complex history are assessed for potential contamination associated with "total metals" to satisfy due diligence requirements pursuant to 310 CMR 40.019. Under these circumstances, the preferred analytical method for Mercury is SW-846 Method 7470/7471 (Cold Vapor AAS).



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Table III A-2 Analyte List for SW-846 Method 6010B

ANALYTE	CASRN	MCP METHOD 1	
		GW-1	S-1/GW-1
		µg/L (PPB)	mg/Kg (PPM)
Antimony	7440360	6 ¹	10
Arsenic	7440382	50	30
Barium	7440393	2000	1000
Beryllium	7440417	4	0.7
Cadmium	7440439	5	30
Chromium (Total)	7440473	100	200 ²
Lead	7439921	15 ¹	300
Nickel	7440020	100	300
Selenium	7782492	50 ¹	400
Silver	7440224	7 (GW-3) 40 (GW-1)	100
Thallium	7440280	2 ¹	8
Vanadium	7440622	50	400
Zinc	7440666	900 (GW-3) 2000 (GW-1)	2500
1. Laboratory Reporting Limits for this element may not be able to achieve MCP regulatory compliance limit using SW-846 Method 6010B. 2. Dermal contact updated Aug 99			



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2.0 Data Usability Assessment for Method 6010B

Overall data usability is influenced by uncertainties associated with both sampling and analytical activities. This document provides detailed quality control requirements and performance standards for SW-846 Method 6010B which may be used to assess the analytical component of data usability. The sampling component of data usability, an independent assessment of the effectiveness of sampling activities to meet data quality objectives, is not substantively addressed in this document.

3.0 Reporting Requirements for SW-846 Method 6010B

3.1 General Reporting Requirements for SW-846 Method 6010B

General reporting requirements for analytical data used in support of assessment and evaluation decisions at MCP disposal sites are presented in WSC-CAM-VIIA. This guidance document provides recommendations for field QC, as well as the required content of the Environmental Laboratory Report, including

- Laboratory identification information presented in WSC-CAM-VII A, Section 2.4.1,
- Analytical results and supporting information in WSC-CAM-VII A, Section 2.4.2,
- Sample- and batch-specific QC information in WSC-CAM-VII A, Section 2.4.3,
- Laboratory Report Certification Statement in WSC-CAM-VII A, Section 2.4.4,
- Copy of the Analytical Report Certification Form in WSC-CAM-VII A, Exhibit VII A-1,
- Environmental Laboratory case narrative contents in WSC-CAM-VII A, Section 2.4.5,
- Chain of Custody Form requirements in WSC-CAM-VII A, Section 2.4.6

3.2 Specific Reporting Requirements for SW-846 Method 6010B

Specific QA/QC Requirements and Performance Standards for SW-846 Method 6010B are presented in Table III A-1. Specific reporting requirements for SW-846 Method 6010B are summarized below in Table III A-3 as "Required Analytical Deliverables (YES)". These routine reporting requirements should always be included as part of the laboratory deliverable for this method. It should be noted that although certain items are not specified as "Required Analytical Deliverables (NO)", these data are to be available for review during an audit and may also be requested on a client-specific basis.

3.2.1 Reporting Data for Spectral Interference Corrections

If unusual inter-element or matrix interferences are encountered, a description of any corrective measures utilized by the laboratory must be included in the Environmental Laboratory case narrative. Such measures may include use of an alternative analytical wavelength, non-standard computerized compensation, sample dilution to overcome physical or chemical interferences, use of standard additions, or other method-specific corrective actions.